Unit VI. Carboxylic Acids and Derivatives

A. Carboxylic Acids
   1. Structure
   2. Acidity
   3. Synthesis
   4. Carboxylic Acid Derivatives

B. Acyl Transfer Reactions
   1. Background
   2. Acid Chlorides/Anhydrides
   3. Esters
   4. Carboxylic Acids
   5. Amides
   6. Evidence for Tetrahedral Intermediate

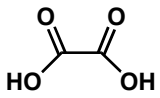
C. Reactions with $NaBH_4$, $LiAlH_4$, RMgBr, RLi

D. Chemistry of Nitriles
   1. Formation
   2. Reactions

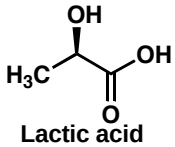
Suggesting reading : 19.2-19.8, 19.11, 20.1-20.9, 21.1-21.7

Suggested problems: 20.23-20.27, 20.34, 20.35, 20.39, 20.41, 20.43, 20.44, 21.36-21.41, 21.44-21.48, 21.51-21.54, 21.56-21.58

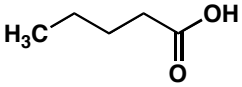
Carboxylic Acids



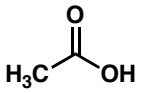
Oxalic acid
(in spinach - toxic!)



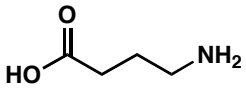
Lactic acid
(sour milk)



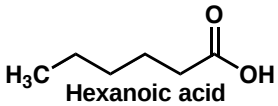
Butanoic acid
Body odor



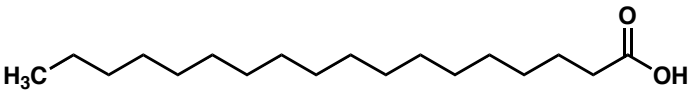
Acetic acid
(vinegar)



Aminobutyric acid (GABA)
(inhibitory neurotransmitter)

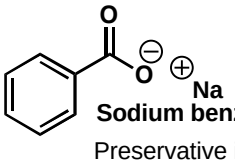


Hexanoic acid
Sweat socks



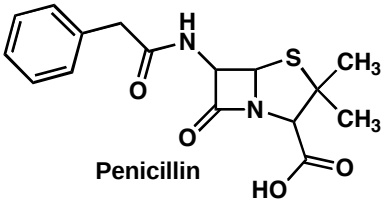
Stearic acid (fatty acid, in soaps, candles, plastics, cosmetics)
Made by treating animal fat with water at high pressure

Carboxylic Acid Derivatives

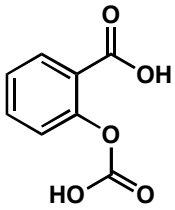


Sodium benzoate

Preservative in soft drinks and baked goods

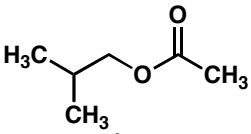


Penicillin



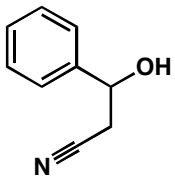
Salicylic acid

aspirin



Isoamyl acetate

Banana smell



Mandelonitrile

in bitter almonds releases HCN, toxic

A. Carboxylic Acids

1. Structure
2. Acidity
3. Synthesis
   a. Oxidation of 1° alcohols and aldehydes
   b. Oxidative cleavage of alkenes and alkynes
   c. Carboxylation of Grignard reagents
   d. Hydrolysis of Nitriles
4. Carboxylic Acid Derivatives
   a. Acid Halide
   b. Anhydride
   c. Ester
   d. Amide

B. Acyl Transfer Reactions

1. Background
   a. Transformation
   b. Relative Reactivity
   c. Mechanism
2. Acid Chlorides/Anhydrides
3. Esters
   a. Hydrolysis
      i. Acid catalyzed
      ii. Base promoted
   b. Transesterification
      i. Acid catalyzed
      ii. Base catalyzed
   c. Amide Formation
4. Carboxylic Acids
   a. Esterification
      i. Acid catalyzed
      ii. Base catalyzed
   b. Acid Chloride Formation
5. Amides
   a. Acid hydrolysis
   b. Base hydrolysis
6. Evidence for Tetrahedral Intermediate
   a. Labeling study - Ester hydrolysis
   b. Labeling study - Acid chloride hydrolysis
   c. Labeling study - Amide hydrolysis

VI. Carboxylic Acids and Derivatives

C. Reactions with $NaBH_4$, $LiAlH_4$, RMgBr, RLi
D. Chemistry of Nitriles
   1. Formation
      a. From alkyl halide (S_N2)
      b. From aldehyde (cyanohydrin)
      c. From arene diazonium salt (aryl nitrile)
      d. From 1° amide ($POCl_3$)
   2. Reactions
      a. To carboxylic acid (hydrolysis, H^+ or ^-OH)
      b. To amine (reduction, $LiAlH_4$)
      c. To ketone (RLi or RMgBr)